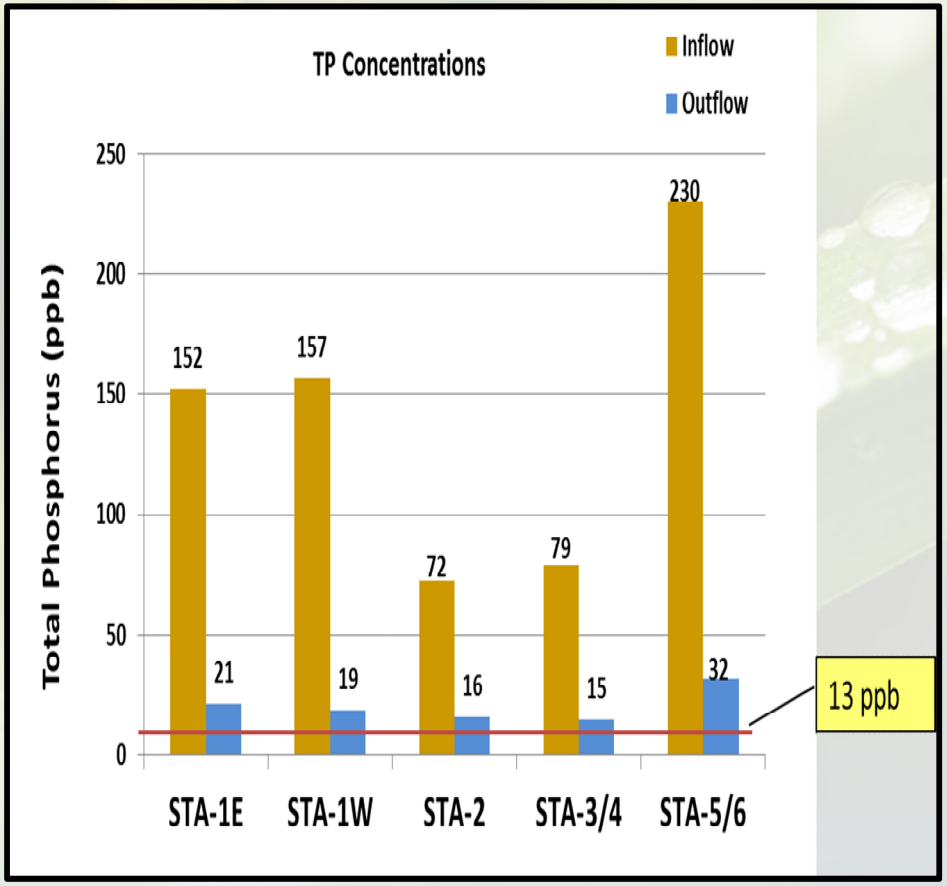
STAs are very effective at removing phosphorus…..

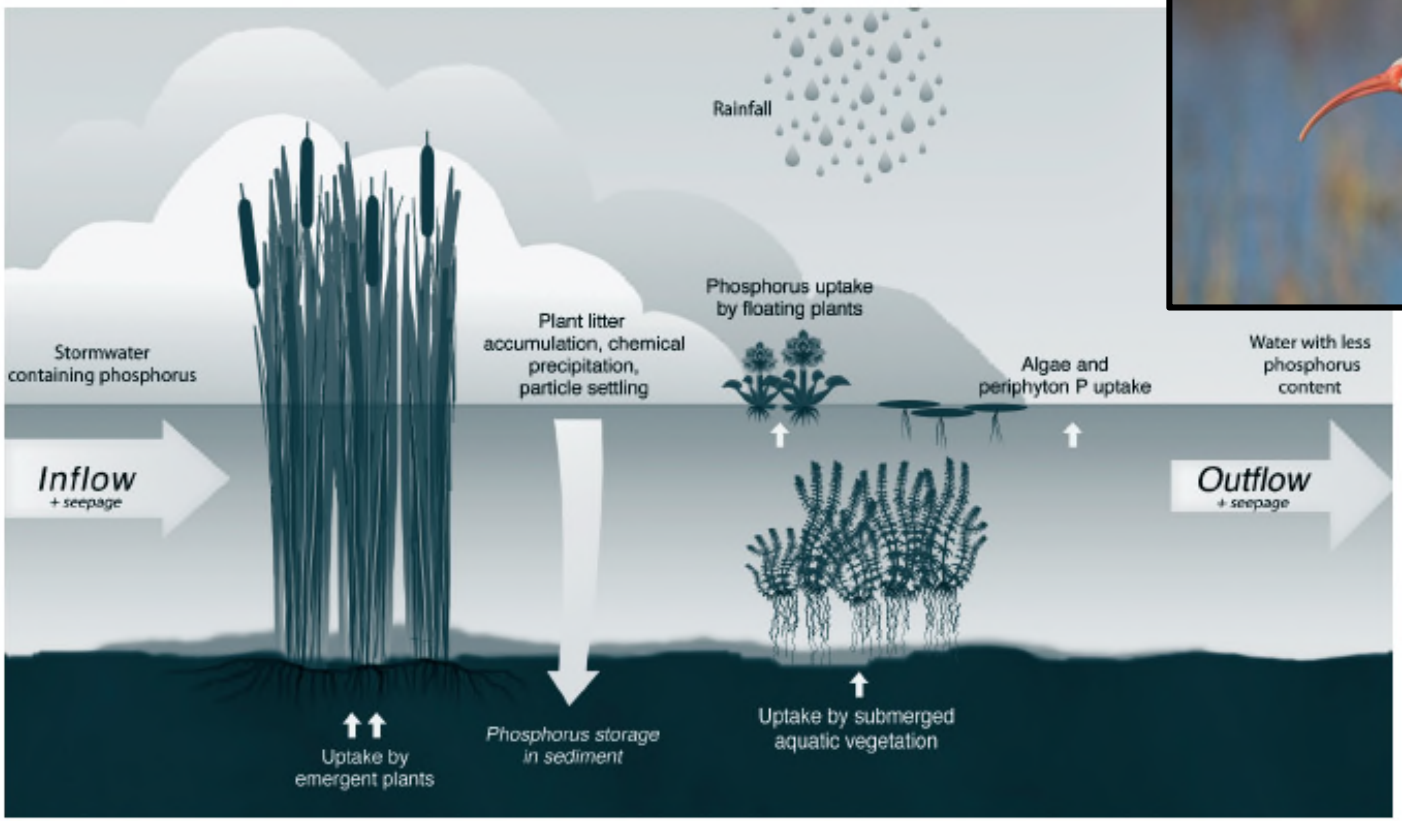


…but we still need to determine how to reach the very low number target

Restoration Strategies Science Plan:

Investigate the factors and mechanisms that influence phosphorus reduction in order to meet the Water Quality Based Effluent Limitation (13 ppb).

Science Plan: Evaluate the sources, transformation, and movement of phosphorus in the STAs

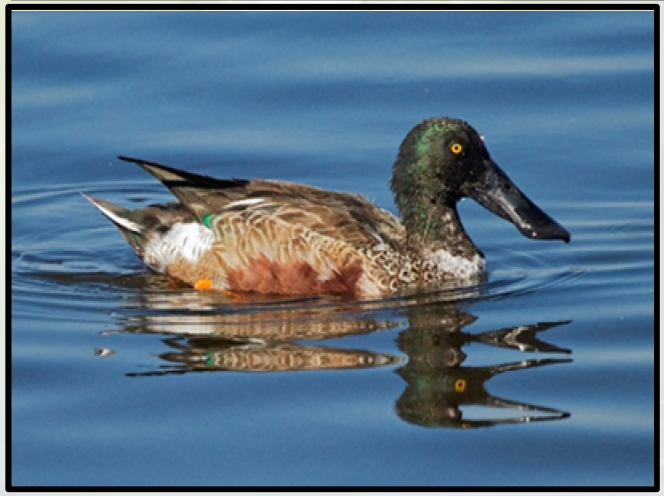


Stormwater treatment areas are constructed wetlands that remove and store nutrients through plant growth and the accumulation of dead plant material in a layer of sediment.

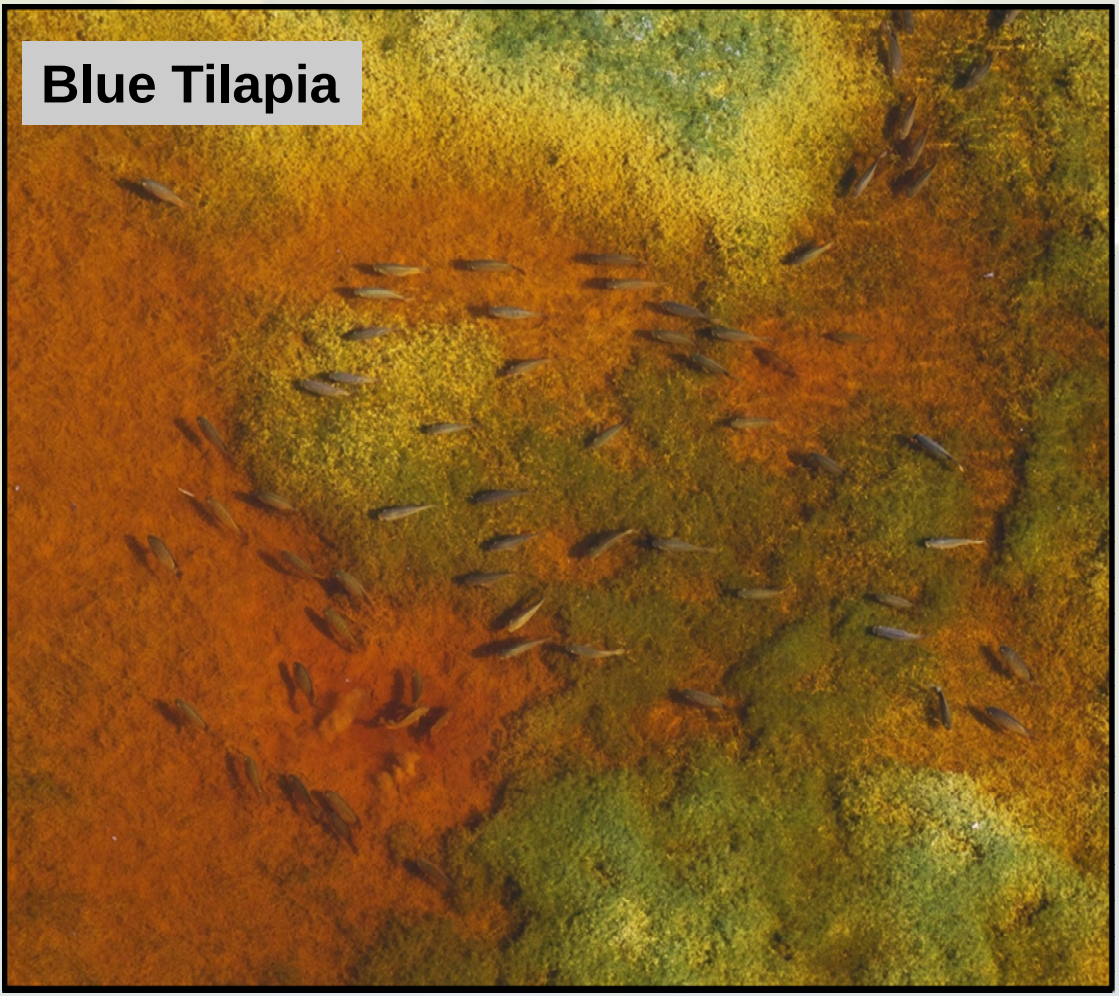
STAs support a highly abundant & species rich animal community

Alligators during a drydown in STA-1E

Ducks & Coots in STA-1W

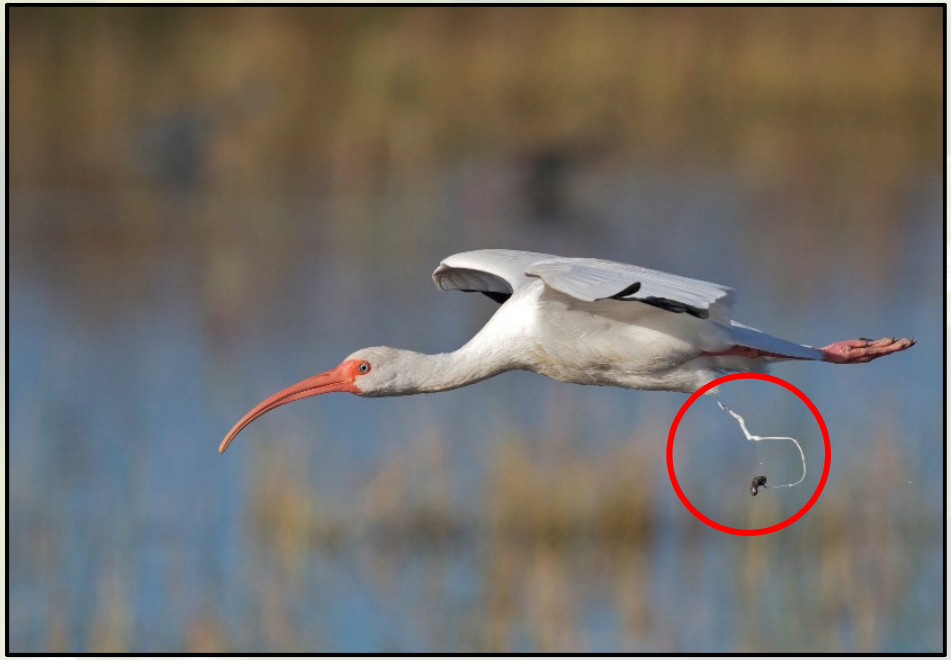


Non-Native Fish and Apple Snails



Wading Birds & American White Pelicans in STA-2

Mechanism 1. Consumption & Excretion



Excretion alters the nature of biological material and rates of nutrient cycling

Transport of P from sediments to water column is a “new” source of P

2. Herbivory

Coot & non-native apple snail consumption of aquatic vegetation

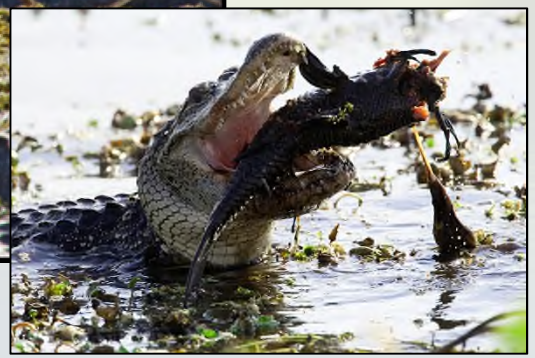
3. Disturbance of Sediments (Bioturbation)

Nesting/burrowing

Foraging

Movements

4. Nutrient Sinks (Storage)



Sinks

- Large, long-lived species
- Growing populations

5. Transportation of phosphorus out of the STAs

Wading birds feed in the STAs and transport prey to nesting colonies

Initial Objectives

1. Estimate abundances of waterbirds and aquatic animals (fish, crayfish, etc.)

2. Obtain food consumption and excretion rate data (from literature & aquarium studies)

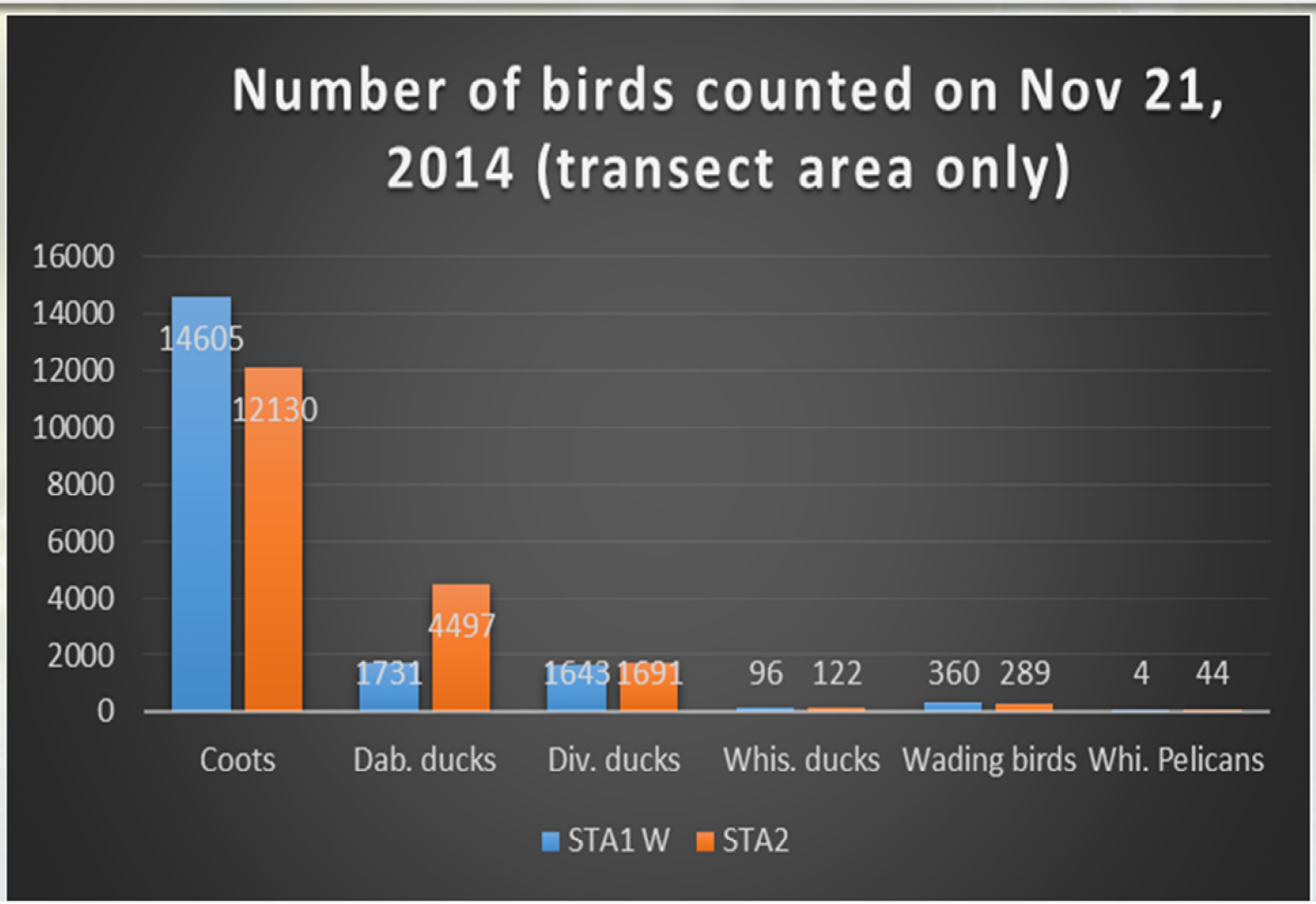
3. Compare population-level excretion rates with P-inflows and outflows and determine effect level.

Wading Bird & Waterfowl Surveys (SFWMD)

- Aerial video surveys of SAV cells
- Fixed transects
- 10% areal cover
- Occur bimonthly from Nov-May (2 years)
- STAs 1E, 1W & 2

Waterbird Video

A Preliminary Look at the Numbers….



Coots are eating and excreting a huge biomass of submerged aquatic vegetation (SAV)!

Assuming:

A count of 14,605 coots (highly conservative estimate)

A consumption rate of 90 g SAV/day (dry wt)

An excretion rate of 54 g guano/day (dry wt)

During 21 November, coots in STA-1W:

Consumed 1315 kg SAV

Produced 789 kg guano

Aquatic Faunal Surveys

Small fish, macroinvertebrates:

1 m^2 throw trap

Large fish:

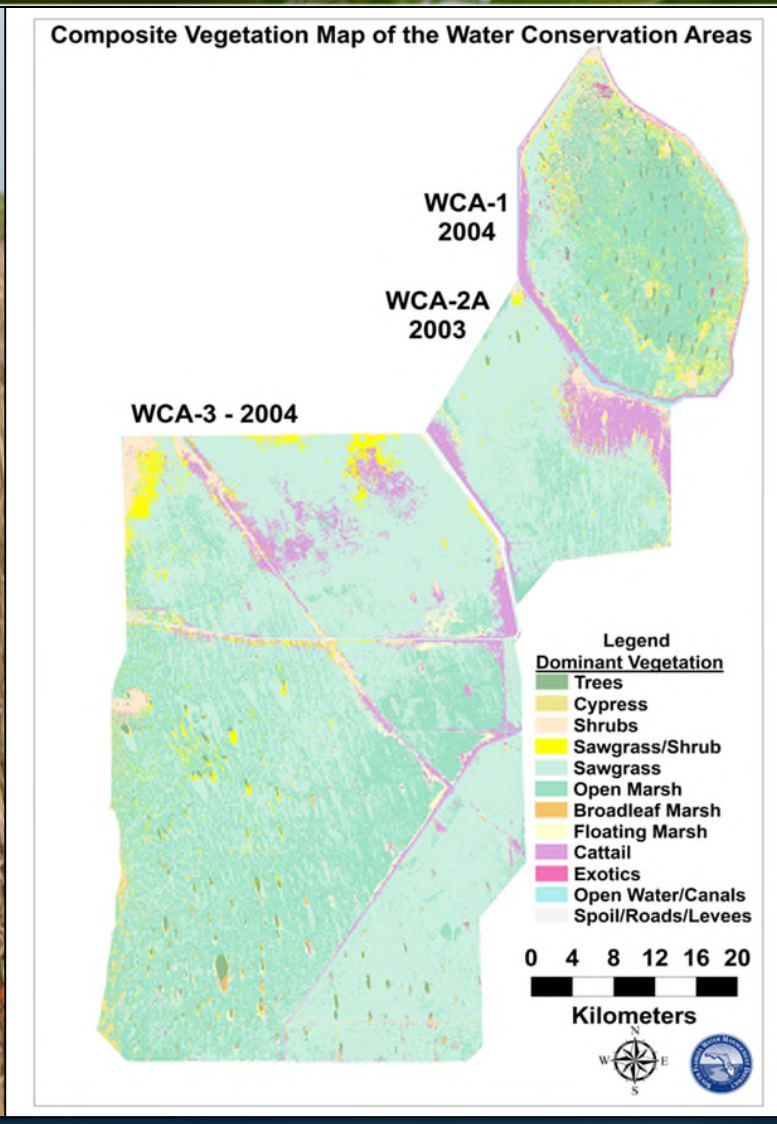
Electrofishing

Fish Video

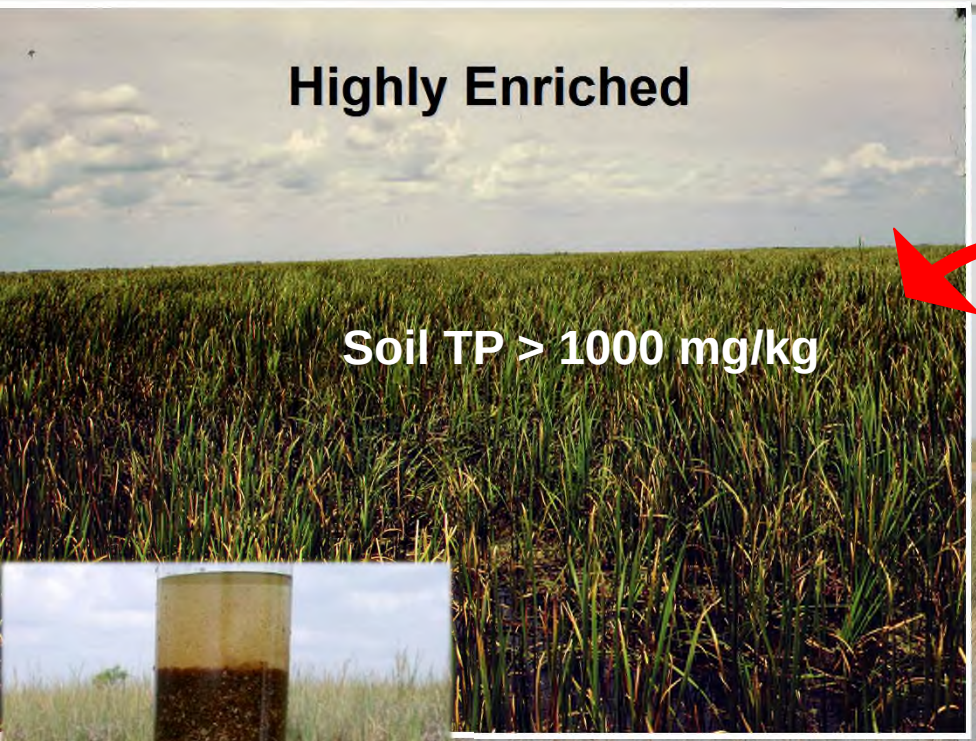
Next Steps?

- Understand habitat preferences for key species
  - (e.g. hydrologic requirements, SAV preferences etc.)
- Consider wildlife management approaches for reducing P-loads in the water column, especially near outflow structures

Project 2: Improving Habitat for Wildlife in the Phosphorus-Enriched Everglades

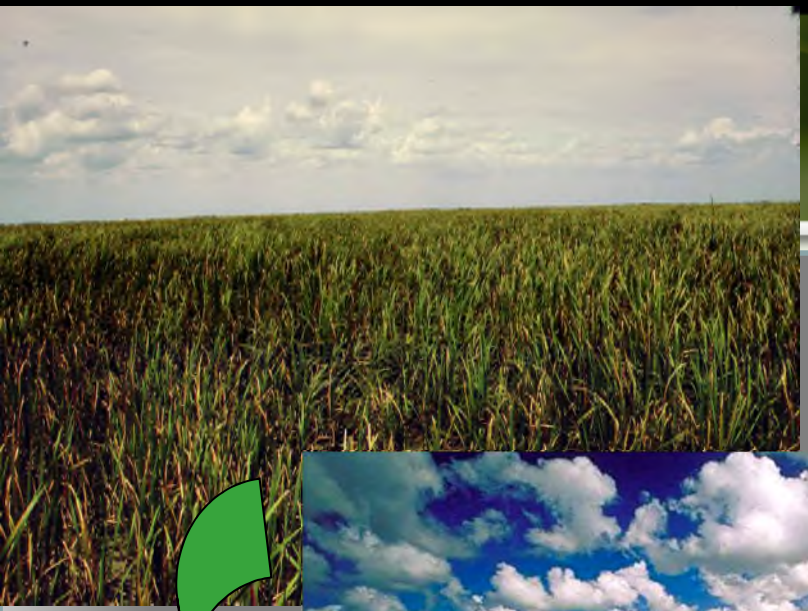


Resistant to Change



Unenriched Ridge and Slough
Soil TP 200-400 mg/kg

Environmental Restoration Approach



Create openings → increased habitat complexity and quality → simulate ridge and slough?

Jump start restoration towards Everglades sawgrass ridge and slough landscape?

Location: WCA2A

Active Marsh Improvement Experiment

Treatments

6 open & control pairs: 3 in an enriched & 3 in a transitional region

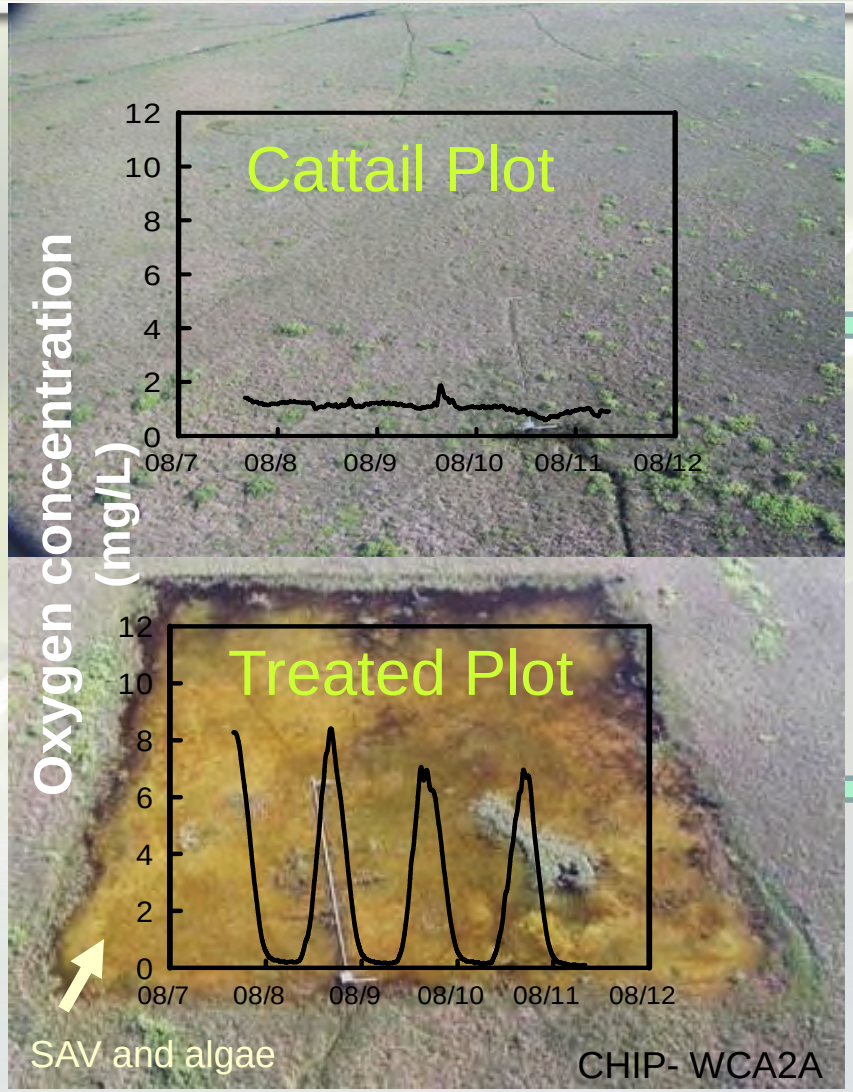
3 additional plots in an unenriched reference region

Primary Objectives

1. To test whether creating openings within densely vegetated areas will sufficiently alter trophic dynamics such that wildlife diversity and abundance is increased.

2. Assess to what extent the structure and function of these created open areas compare to the natural Everglades.

Oxygen, Fish and Crayfish Responses

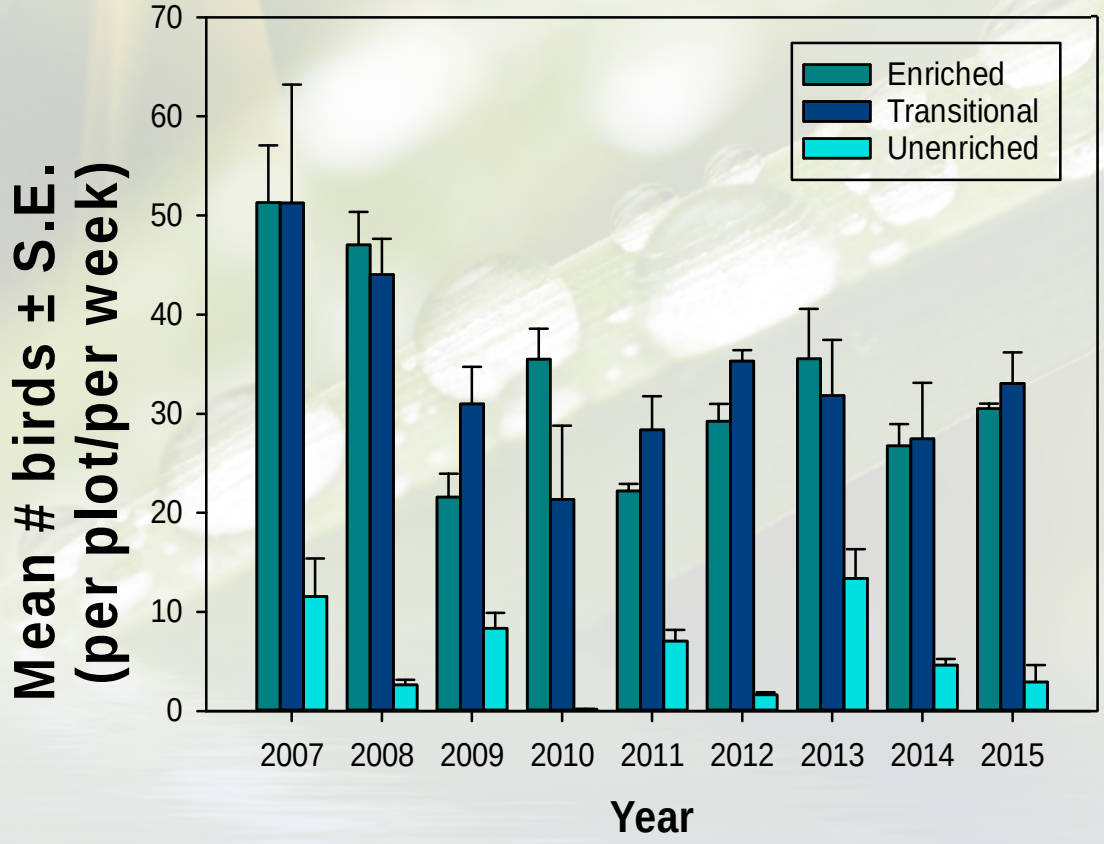


Cattail (control) plots had greater crayfish biomass

Treated plots had greater fish biomass

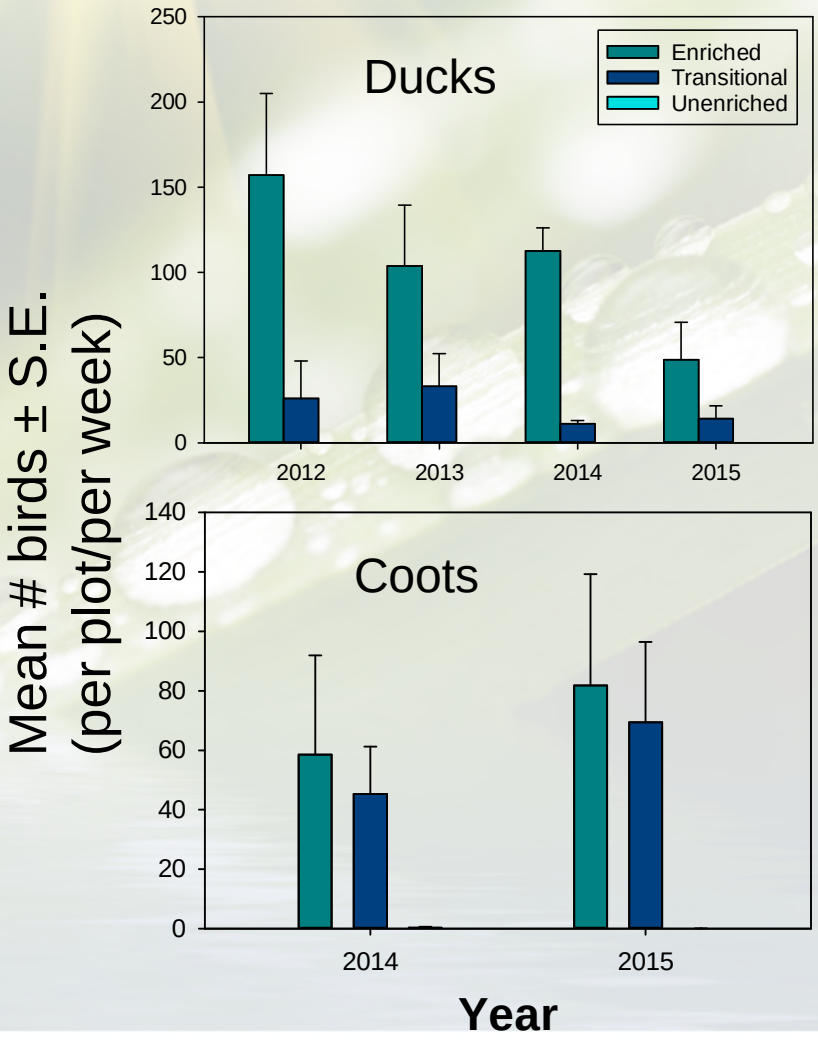
Mosquito fish

Greater Wading Bird Usage of Open Plots compared to Unenriched Reference Area



CHIP Plots-WCA2A

Greater Waterfowl Usage of Open Plots Compared to Unenriched Reference Area

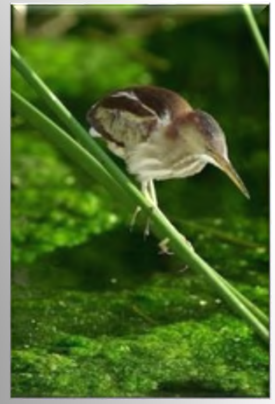


CHIP Plots-WCA2A

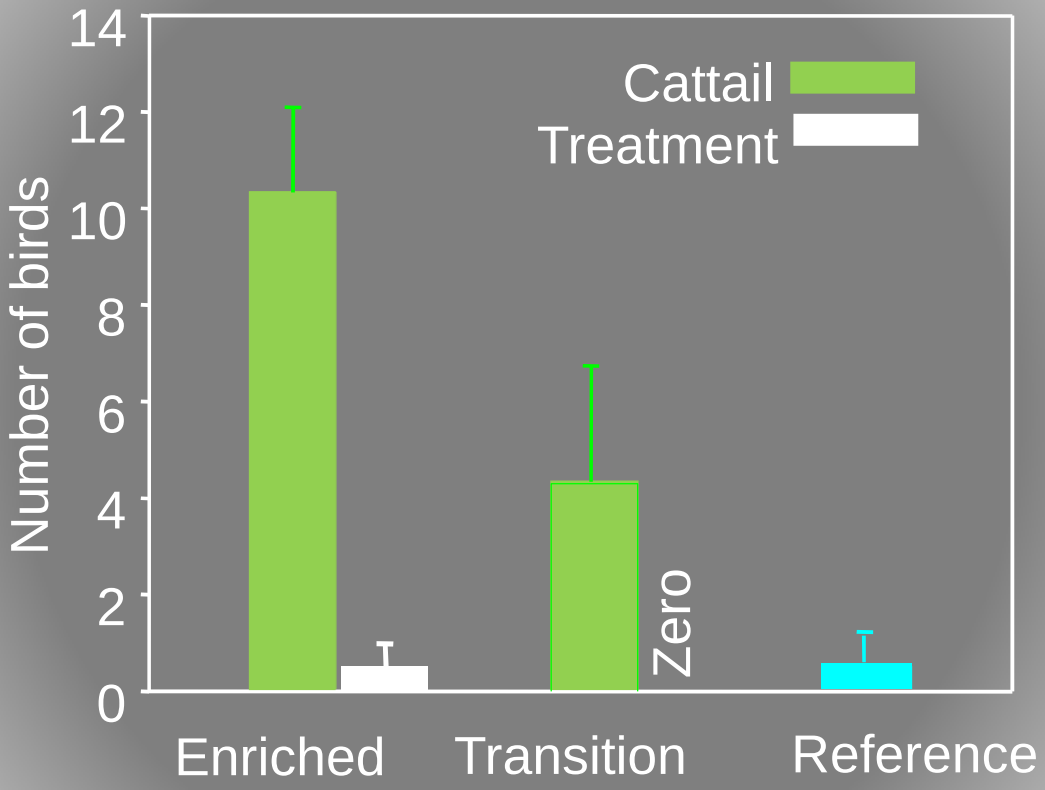
Emergent Vegetation Important Habitat for Federally Listed Species of Rails and Bitterns

Cattail IS the emergent community in enriched areas

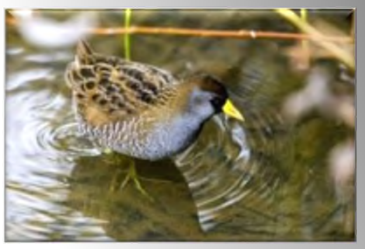
King rail



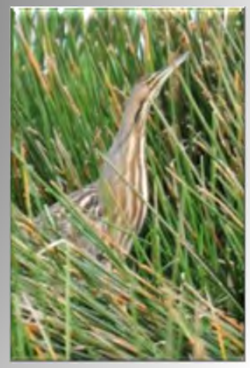
Least bittern



Number (mean ± S.E.) of rails and bitterns per plot

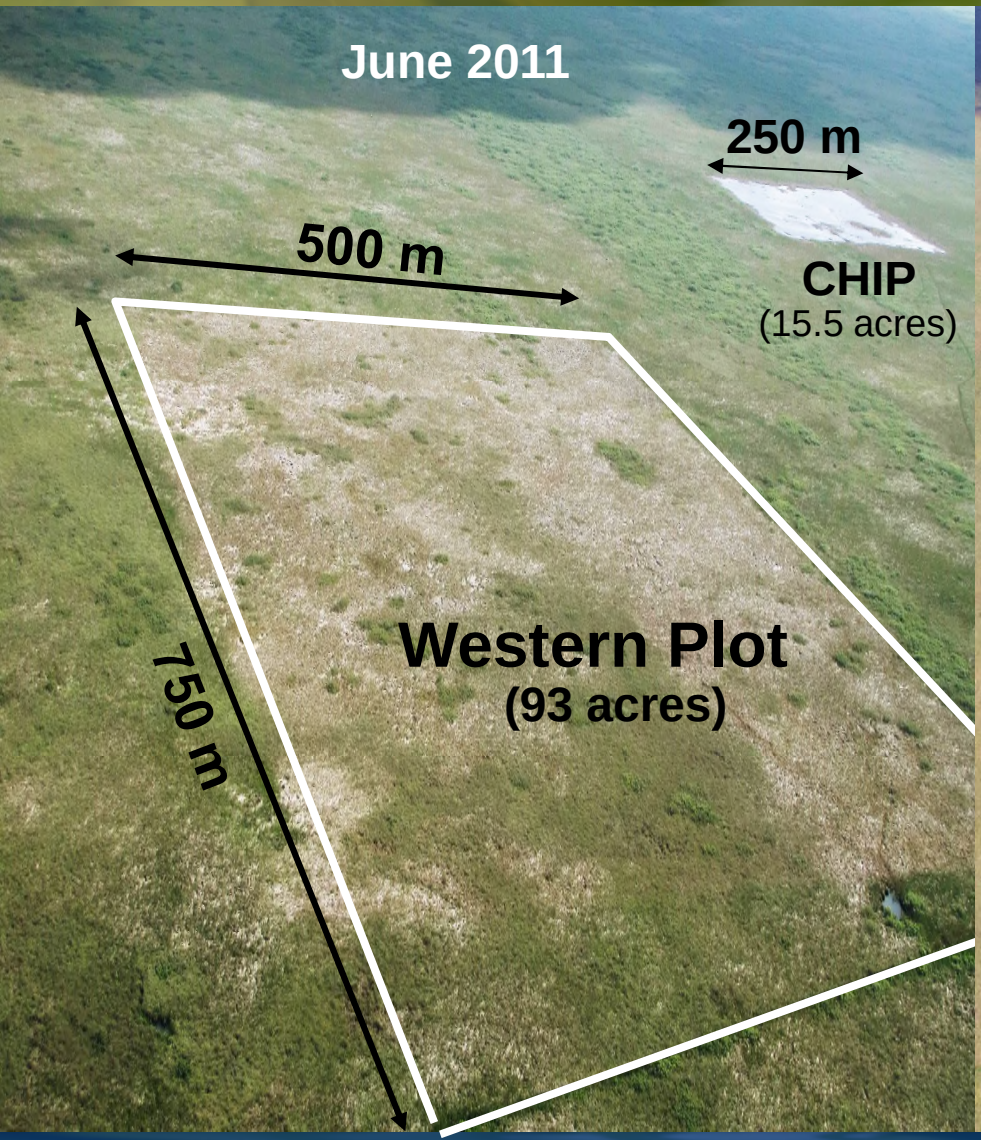


Sora rail

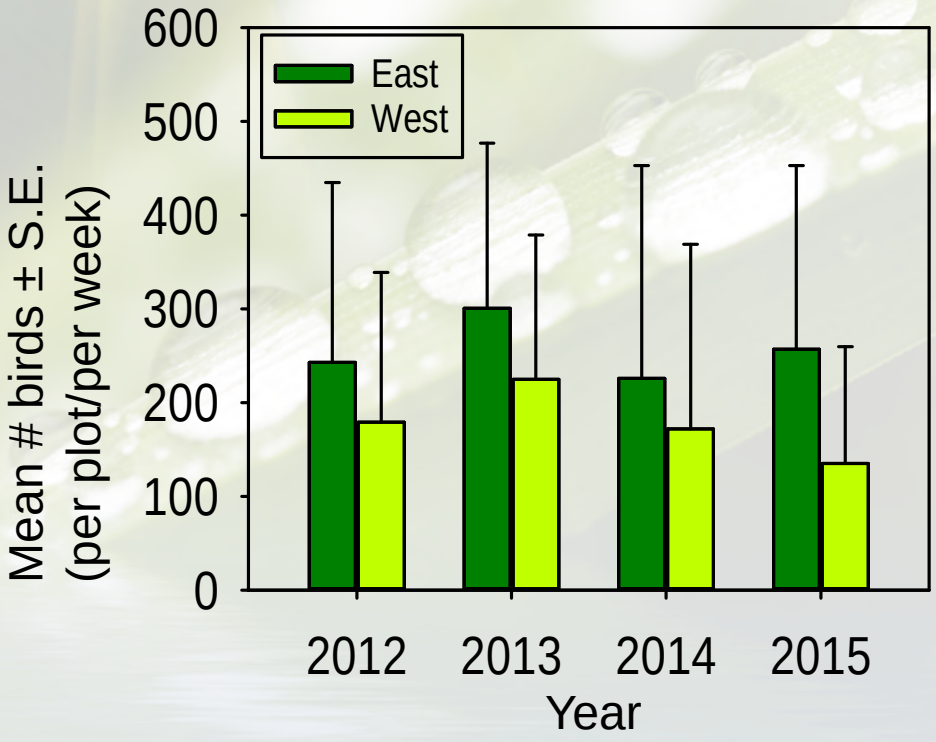


American bittern

Landscape Pattern Restoration



Significant Active Marsh Improvement Results



- Hundreds of birds per week, in the same location
- Plots attracts birds when conditions are poor elsewhere (e.g., reversals)
- Can be sustained in the long-term (10 yrs)
- Is applicable in many areas of the Everglades

Next Steps: How to Improve Effectiveness of Management in Dense Cattail Areas

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